New Carrollton Station

Future Bus Facility Needs and Short-Term Access Assessment

May 2011

New Carrollton Station Future Bus Facility Needs and Short-Term Access Assessment

Final Report

Washington Metropolitan Area Transit Authority
Department of Planning and Joint Development
Office of Station Area Planning and Asset Management

May 2011

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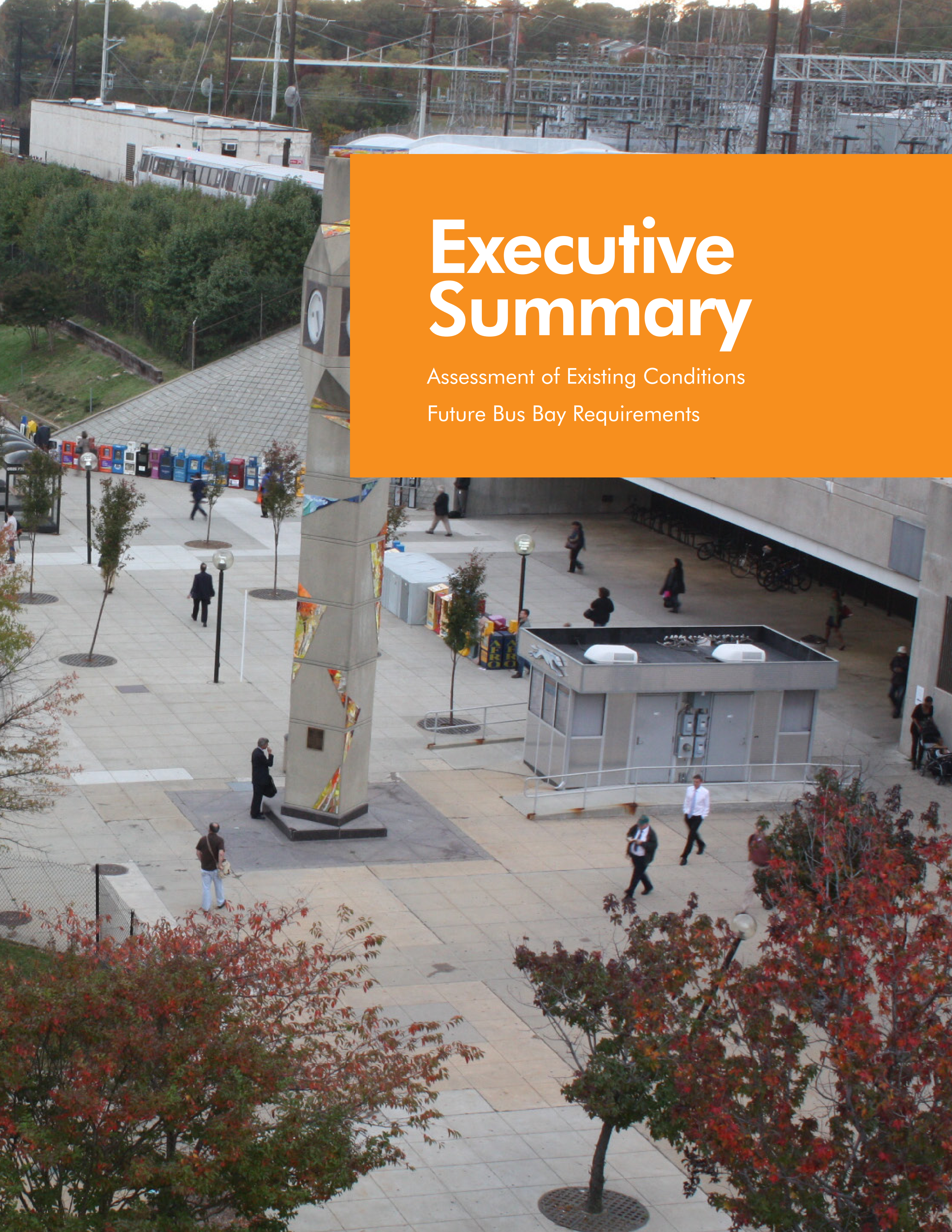

Executive Summary

On May 4, 2010, the Prince George's County Council approved the New Carrollton Preliminary Transit District Development Plan (TDDP) and Transit District Overlay Zoning (TDOZ) Map Amendment. The new plans envision a high density, mixed use urban center. The TDDP includes four plan areas which are bounded by Annapolis Road, Interstate 495, John Hanson Highway, and Veterans Parkway. The plan anticipates over five million square feet of new office/retail/hotel/entertainment space and up to 5,500 new residential units with the Metro Core, one of the four plan areas, containing the highest density with approximately 2.5 million square feet of this new development along with up to 3.000 new residential units. The TDDP vision for development of the Metro Core area includes high-intensity transit oriented development, walkable, with active ground-floor uses and direct visual connection to adjacent streets. The County envisions a renovated Metro station as a centerpiece of a new "downtown" location. WMATA, in partnership with Prince George's County and the State, has recently issued a Request for Qualifications to select a developer to develop three sites in the vicinity of the station: Metro North (approximately eight acres), Metro South (approximately 17 acres) and State South (approximately 16 acres).

New Carrollton Metrorail Station is already a busy transit center with over 10,000 Metrorail boardings and 3,500 bus boardings on a typical weekday. The full build-out as envisioned by the TDDP could significantly increase passenger activity and the need for more bus bays.

The primary focus of this study is to determine the future need for bus bays at New Carrollton in support of upcoming redevelopment of Metro and State owned property. In addition, this study documents existing access constraints and make recommendations for short-term improvements that can be implemented to enhance the safe and efficient circulation of buses, automobiles, bicyclists, and pedestrians in the station vicinity.

Assessment of Existing Conditions

Bus Operations

There are four bus bays on the west side of the station and six bus bays on the east. The original design may have assumed that the growth in bus trips would be from the east, or perhaps the west side was physically constrained. Whatever the reason, bay utilization on the west side is much higher than on the east, with 26 buses/hour using four bays compared to 20 buses/hour using six bays on the east side. All bays on the west side are at 100 percent or higher utilization, creating congestion and bottlenecks that are described in the later section Assessment of Existing Conditions. East side bay utilization is generally less than 60 percent, with bay F being the only bay with a utilization greater than 60 percent. Table ES-1 lists the current utilization rate for each bus bay.

Buses layover in a variety of locations, some designated on-site, while others use more informal locations on Ellin Road. There are limited locations to layover on the east side because of the roadway and entrance layout. On the west side, buses are laying over

Table ES-1: Existing Bus Bay Utilization

Route	Bay	Peak Hour Buses/Hour	Total Time at Bay	Bay Utilization
West Side				
84, B24, B25, B27	G	7	87	145%
F4, F6	H	6	76	127%
R12, T16, T17	J	4	62	103%
F13, F13, T18, TB15X, TB16	K	9	86	143%
Total		26		
East Side				
B29, B31, Greyhound	A	3	27	44%
B21, B22, C28	B	4	36	60%
F14	C	2	22	37%
F12	D	4	24	40%
88, 921	E	3	17	29%
TB21, TB21X	F	5	50	83%
Total		20		

in several locations that are causing congestion during peak periods.

Recommendations

East Side
- Recommend training and enforcement to restrict drivers from laying over in the entrance drive.
- Recommend removal of security booth from left lane of exit drive and designating that lane as a temporary layover area.
- Recommend training and enforcement to provide better customer service.

West Side
- Recommend striping and signing for layover spaces on-site and eliminating layover on entrance drive. There is space along the eastbound lanes on Ellin Road to layover but it is accessible only to buses entering service from the garage. That space would be time-consuming for revenue buses to access unless a turnaround is constructed allowing buses to make a U-turn from westbound to eastbound Ellin Road.

Parking and Entrance Drives

The east station entrance drive is the access point to the Metro garage, with three gates entering the facility. The decision point is quick after turning into the entrance drive, but most parkers are repeat customers. Signage to the garage is inadequate, however, with no signs on-street informing drivers of the garage. Signs do direct drivers to the surface lots, but the majority of parking is located in the garage. Daily parking is completely full on weekdays Tuesday through Thursday. The station's proximity and easy access from US 50 and I-495 makes it very popular for commuters.

The surface parking lot entrance on the west side is at the intersection with Ellin Road and Harkins Road, which works well. All movements in and out of the lot are signalized. This can create a small queue when exiting through the gates waiting for the light, but the use of SmarTrip and dual exit lanes limit the length of the queue. Additionally the lot is not large so the volume of autos leaving at one time remains small.

Recommendations

East Side
- Recommend installing signage on the entrance roadway that indicates the entrance to the daily parking garage.
- Recommend examining feasibility of striping two right-turn lanes at exit.

Kiss & Ride Facilities

Two lanes on the east entrance drive are marked as entrances to the Kiss & Ride; however, the lanes narrow at the Kiss & Ride entrance and frequently become blocked. The taxi queue often extends out to the bus lane entrance. Kiss & Ride drivers are sometimes confused, stopping behind the taxi queue before realizing their error. The Kiss & Ride activities themselves often block the entrance drive back to the intersection with Garden City Drive. For example, Kiss & Ride drivers are picking up and letting out along the travel lane just inside the Kiss & Ride facility rather than pulling into designated spaces. The result is that many of the Kiss & Ride spaces go unused while a line develops entering the Kiss & Ride as drivers pick up their passengers near the crosswalk.

The west side Kiss & Ride contains 24 metered midday parking spaces and eight additional pull-through spaces. As with the east side, drivers often stop in the travel lanes to pick up their passengers, blocking following traffic. Kiss & Ride vehicles are able to exit the station area via the unsignalized exit with little difficulty because traffic volumes on Ellin Road are not excessive.

Taxis queue up during the PM to the Kiss & Ride entrance and continue queuing in the curb lane of Ellin Road.

Figure ES-1: Passenger Queues on the East Side

There is space for approximately nine taxis on site before blocking the Kiss & Ride entrance. Some taxis park in the Kiss & Ride spaces because the queue is too long.

Recommendations

East Side

- Recommend signage, stripping, and enforcement to keeping taxi queue from extending into driving lanes.
- Recommend removing the first several Kiss & Ride spaces on left and signing "NO STOPPING to load/unload" on pavement.
- Recommend examining different layouts for Kiss & Ride that provides more curbside pickup and more pull-thru spaces.

West Side

- Recommend continued enforcement of taxi queue length.

Pedestrian Network

The east side pedestrian network connecting the station entrance to the parking facilities, Kiss & Ride and taxi stand, and the surrounding neighborhood works acceptably well. There are multiple paths to the parking garages, and the sidewalk network to the neighboring businesses is typically offset from the roadway with a tree-lined median, improving safety. The sidewalks in front of the east side of the station entrance are crumbling and need repair. A fence has been installed to protect a grassy area from foot traffic, but people simply walk around the fence and onto the grass.

The west side waiting area in front of the bus bays is small and easily becomes congested during the PM peak period as passengers exit the escalators from the Metro station and wait for buses.

Recommendations

East Side

- Recommend installing sidewalk where now dead grass and remove fence.
- Recommend repair or replace crumbling sidewalks.
- Recommend installing benches and shade near the station entrance.

West Side

- Recommend studying the feasibility of short-term station improvements.

Future Bus Bay Requirements

The major determinant of the number of bus bays is the average length of time each bus remains at the bay. Normal practice is for buses operating on routes that terminate at a station to layover at the assigned bay, schedule permitting. Tight schedules or sharing of bays may require buses to layover at another location on or off-site. Turnover rates at bays with terminating buses generally average six to seven buses per hour.

Three scenarios were tested:

1. 2030 with Purple Line and current demographic projections, using travel demand results for each route.
2. 2030 with Purple Line and full build-out, using travel demand results for each route.
3. 2030 with Purple Line and full build-out, with 46 percent increase in bus boardings for every route.

In all three cases the number of bays required is 13, with eight bays on the west side and five bays on the east side. Routes could be assigned similar to that shown in Table ES-2.

Table ES-2: Future Bay Utilization

Route	Bay Number	Peak Hour Buses/ Hour	Total Time at Bay	Bay Utilization
West Side				
84, T18	1	6	60	100%
B24, B25	2	4	42	70%
B24, B25	3	4	42	70%
B27, F4	4	4	46	77%
F6	5	5	50	83%
R12	6	4	56	93%
F13, T16, T17	7	4	34	57%
TB15X, TB16	8	4	36	60%
East Side				
88, B21, B22, Greyhound	9	5	38	63%
B29, B31, C28	10	4	38	63%
F12	11	6	36	60%
F14, 921, Greyhound	12	5	53	88%
TB21, TB21X	13	6	42	70%


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Section 1
Introduction

Introduction

The New Carrollton Metrorail Station is a major terminal station and transit center with over 10,000 Metrorail boardings and 3,500 bus boardings on a typical weekday. Ten bus bays, six on the east and four on the west side of the station, today serve more than 410 daily bus trips. Station activity is expected to increase as development expands in the surrounding area, fueled by the recent Transit District Development Plan (TDDP) for New Carrollton, and the market shed east and northeast of the station. The TDDP envisions an additional 5,000,000 square feet of office space, 1,600,000 square feet of retail space, and 5,500 new residential units in the next 20 years, surrounding the Metro Core focused on a renovated Metrorail station and the Harkins Road area. Additional growth along the US 50 and MD 450 corridors will increase the demand for bus service and bus bays at the New Carrollton Metrorail station.

An Amtrak station is co-located with the Metrorail mezzanine entrance, with its own waiting and ticketing area. Forty-three Amtrak and 52 MARC commuter trains serve the station each weekday. The Amtrak platform is located immediately west of the Metro platform. A pedestrian tunnel connects the two sides of the station, with access from the tunnel to the Metro mezzanine, Amtrak ticketing and waiting area, and Amtrak/MARC platform. Train frequency is expected to increase in the future by about 50 percent as MARC improves its service and Amtrak responds to growing demand for intercity travel.

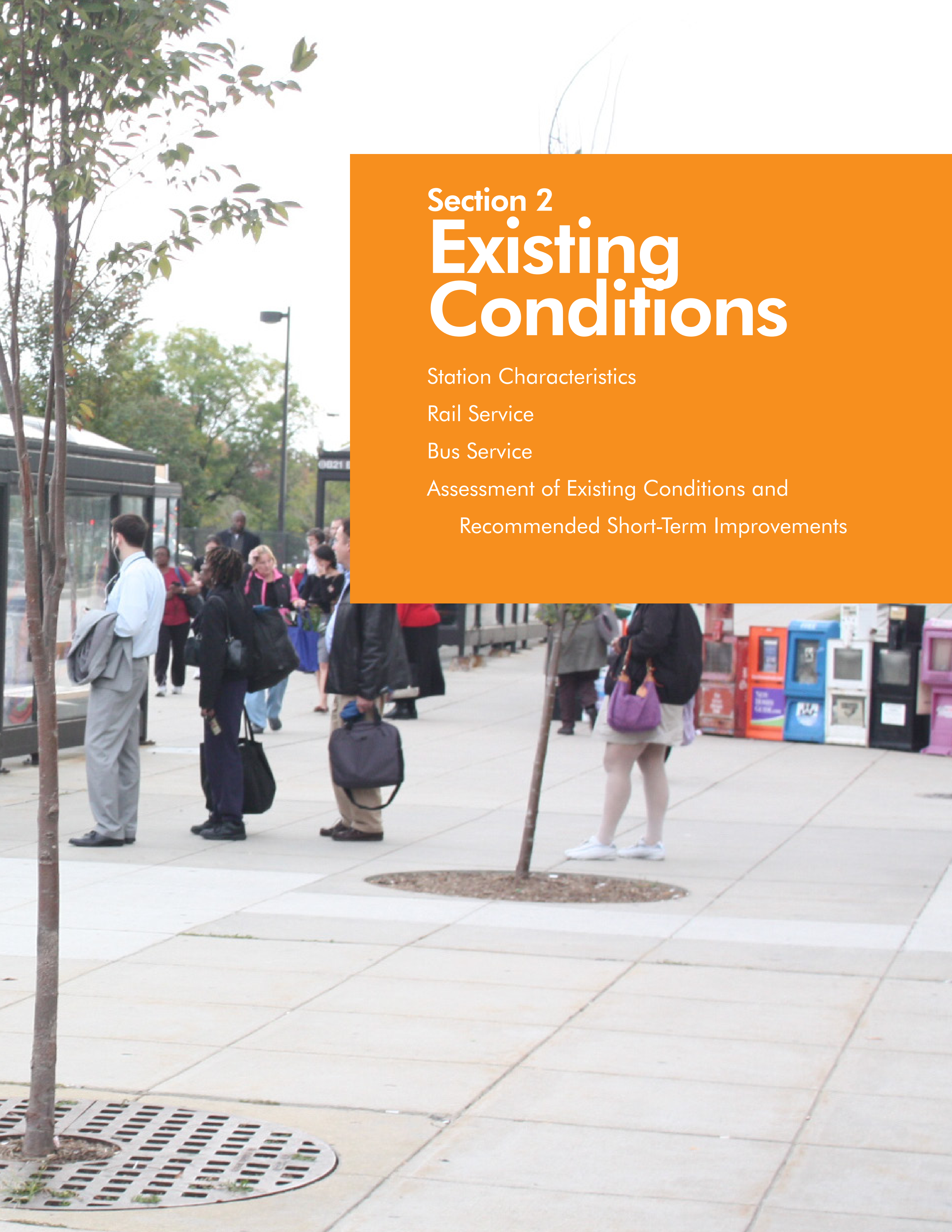
Figure 1: New Carrollton Metrorail Station Surrounding Area

Source: All aerial photos from Google Earth

Greyhound also serves this station, with a small kiosk on the east side and at least 14 buses per day using bus bay A in front of the station entrance.

The primary focus of this study is to determine the future need for bus bays at New Carrollton in support of upcoming redevelopment of Metro and State owned property. In addition, this study documents existing access constraints and make recommendations for short-term improvements that can be implemented to enhance the safe and efficient circulation of buses, automobiles, bicyclists, and pedestrians in the station vicinity.


bus
B29 B31
BEST BUY
NATIONALS



Section 2
Existing Conditions

Station Characteristics

Rail Service

Bus Service

Assessment of Existing Conditions and
Recommended Short-Term Improvements

Existing Conditions

The New Carrollton station is a major transit center serving rail, bus, auto drivers and passengers, pedestrians, and cyclists. The station plays an important role in the suburban Maryland transportation network by facilitating many transfers. Twenty-four bus routes serve the station. In addition, there are two dedicated Kiss & Ride lots, two taxi stands, Zipcar spaces, as well as bicycle racks and lockers. Parking includes 3,520 spaces in a garage and five surface lots, additional 400 public spaces in a second adjacent garage, and 247 short-term metered spaces in Kiss & Ride lots on both sides.

Station Characteristics

The station includes facilities on both the west and east sides of the station. The west side includes four bus bays, Kiss & Ride area, taxi stand, and two surface parking lots accessed from Ellin Road, which connects with Harkins Road and Annapolis Road. The east side includes six bus bays, Kiss & Ride area, taxi stand, three surface parking lots, and a Metro parking garage accessed from Garden City Drive, with connections from US 50, Capital Beltway (I-495/I-95), and Pennsy Drive. Prince George's County operates a second garage with 400 spaces allocated for monthly passes, but the entire garage is available for Metro, MARC, and Amtrak patrons paying a daily rate.

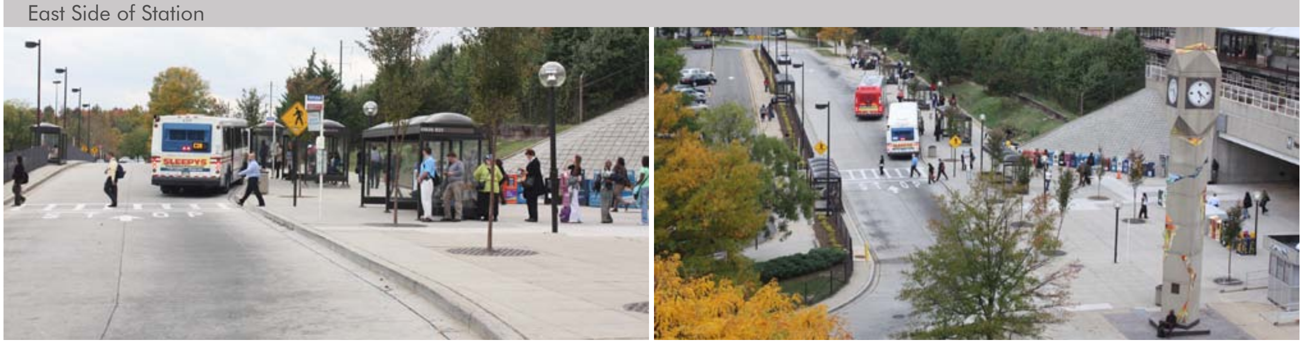
Bicycle racks and lockers are located near both entrances of the station. Pedestrians can access the station from any direction using crosswalks, with pedestrian signals

Table 1: New Carrollton Station Elements

Element	Quantity
Mezzanine	1
Entrances	2
Faregates	9
Farecard vendors	10
Exitfare	2
Elevators	1 (platform to mezzanine)
	1 (tunnel to west side)
Escalators	2 (platform to mezzanine)
	1 (tunnel to west side)
Stairs	1 (platform to mezzanine)
	1 (tunnel to west side)
Bus bays	4 West Side
	6 East Side
Bicycle racks	18
Bicycle lockers	16
Parking spaces	3,920 all day
	247 short term

Source: WMATA

East Side of Station



West Side of Station

Figure 2: Overview of the New Carrollton Bus Bays

Figure 3: Overview of the New Carrollton Station Facilities

Figure 4: Detail of New Carrollton Station Facilities

at all adjacent major intersections. Pedestrian areas around the station are generally worn out, with cracked sidewalks. Currently there is little pedestrian access on the east side because walking distances to nearby businesses in Garden City are longer than most people find comfortable. On the west side, a pedestrian bridge connects the station with the federal buildings west of Ellin Road, providing an easier and covered walk to the IRS offices and the Maryland Computer Science Corporation building.

Rail Service

Characteristics

New Carrollton is the terminal station on the east end of the Orange Line. Peak period headways are six minutes, with 12- to 15-minute headways midday and evening, typical for suburban Maryland stations. Table 2 summarizes rail frequency at the New Carrollton station while Table 3 identifies the travel time from New Carrollton to Vienna and intermediate points.

Ridership

Ridership today at New Carrollton is typical for a suburban commuter station, with 77 percent of passenger activity occurring during the peak periods. Reverse commute trips account for only 15 percent of the AM peak period, reflecting the lack of businesses within walking distance of the station and the availability of plentiful free parking that discourages transit use. More than 20,900 passengers enter and exit the station on a typical weekday. The morning is the busiest time of the day with about 8,430 passengers, or roughly 40 percent of all trips. Ridership has increased at this station by approximately 13 percent between 2002 and 2010,[1] about average for Metrorail stations.

Figure 5: Pedestrian Bridge Connecting New Carrollton Station to Federal Buildings

Transfers/Mode of Access

According to the 2007 WMATA Rail Ridership Survey, 52 percent of Metrorail passengers park at the station, 10 percent walk, and 24 percent transfer from bus. Another 14 percent carpool or are dropped off.

Table 2: Metrorail Frequency at Station

Day	Period	Headway (minutes)
Weekday	AM Peak	6
	Midday	12
	PM Peak	6
	Early evening	12
	Late evening	20
Weekend	Morning	15
	Midday	12
	Evening	15

Source: WMATA

Table 3: Travel Time from Station

To	Time (minutes)
Stadium-Armory	14
L'Enfant Plaza	23
Metro Center	28
Rosslyn	35
Vienna	57

Source: WMATA

Table 4: Average Weekday Metrorail Ridership

Period	Entry	Exit	Total
Morning	7,190	1,240	8,430
Midday	1,600	1,470	3,070
Afternoon	1,340	6,360	7,700
Evening	450	1,275	1,720
Total	10,580	10,350	20,930

Source: 2010 WMATA Faregate Data

Table 5: Mode of Access to Station

Mode	Share
Drive Car	52%
Bus	24%
Walk	10%
Drop Off	10%
Carpool	4%
Taxi	1%

Source: 2007 WMATA Rail Ridership Survey

Bus Service

Routes and Frequency

New Carrollton station is served by 25 bus routes, 8 of which (B21, B22, B24, B25, B27, B29, B31, C28) can be characterized as commuter routes connecting Bowie with Metrorail.

Dillon's Bus continues to operate a long-distance commuter bus route from Annapolis (D921) after MTA discontinued the service in early 2009. The remaining 16 routes provide local service to the surrounding communities, as shown in Table 6 and Figures 6 and 7.

Ridership

The importance of the station as a transit center is underscored by the transfer data from the 2007 WMATA bus survey that found 34 percent of bus passengers transfer to or from another bus while 26 percent transfer to or from Metrorail. Over 30 percent

Table 6: Bus Service at New Carrollton

				AM Peak		Midday		PM Peak		Evening			
Bay	Route	Destination	Serving	To	From	To	From	To	From	To	From	Sat.	Sun.
East Side of Station													
A	B29	Crofton	Bowie P&R, Crain Hwy	40	40^			30*	30				
	B31	Gateway Center	Bowie P&R, Bowie Town Center							60*	60		
B	B21	Bowie State University	Bowie P&R, Laurel-Bowie Rd		30			30					
	B22	Bowie State University	Bowie P&R, The Market Place	30		70	70		30				
	C28	Pointer Ridge Dr	Bowie P&R, Bowie Health Center	30	30			30	30				
C	F14	Naylor Road Station	Glenarden, Capitol Heights Station, Addison Road Station	30	30	50	50	30	30			50	
D	F12	Cheverly Station	Ardwick Industrial Park, Landover Station, Columbia Park	35	35	60	60	35	35				
E	88	Laurel	S Laurel P&R, Town Center	3 trips					3 trips				
	921	Annapolis	Annapolis Rd, Harry S Truman P&R	45#	2 trips	1 trip	1 trip	45	45	1 trip			
F	TB21	Equestrian Center	Landover Mall, Large Station, PGCC, Co Admin Building	30	30	60	60	30	30				
	TB21X	Prince George's Community College	Landover Mall, MVA		20	30	30	30	30				
West Side of Station													
G	84	Rhode Island Station	Westbrook Dr, Riverdale Rd, Kenilworth Ave, Bladensburg Rd	20	20	60	60	25	25	60	60	60	60
	B24	Bowie P&R	The Market Place	35		60		60		30*	60*		
	B25	Bowie P&R	The Market Place, Bowie Health Center		35		60		30				
	B27	Bowie State University	Lanham, Glen Dale	30	30			30	30	60	60		
H	F4	Silver Spring Station	Riverdale Rd, Prince George's Plaza Station, East-West Hwy	15	15	40	40	15	15	30-60	60	30	30
	F6	Silver Spring Station	College Park, Prince George's Plaza, and W Hyattsville Stations	30	20-30	40	40	30	30	30	40-70		
J	R12	Deanwood Station	Greenbelt and College Park Stations	30	30	60	60	30	30				
	T16	Greenbelt Station	NASA, Greenbelt Station			60	60					60	60
	T17	Greenbelt Station	Goddard Corporate Park, NASA	30	30			30	30				
K	F13	Washington Business Park	Lanham, Springdale	30	30	60	60	30	30				
	F13	Cheverly Station	Annapolis Rd, Landover Rd	30	30	60	60	30	30				
	T18	Rhode Island Station	Annapolis Rd, Bladensburg Rd	20	15-20	30	30	20	20	45	45	30	45
	TB15X	Greenbelt Station	Goddard Space Center	80	80			80	80				
	TB16	Greenbelt Station	New Carrollton Mall, Doctors Hospital, Beltway Plaza	30	30	60	60	30	30				

Key: ^ 2 Trips, * 3 Trips, # 4 Trips

Source: 2007 WMATA Bus Survey

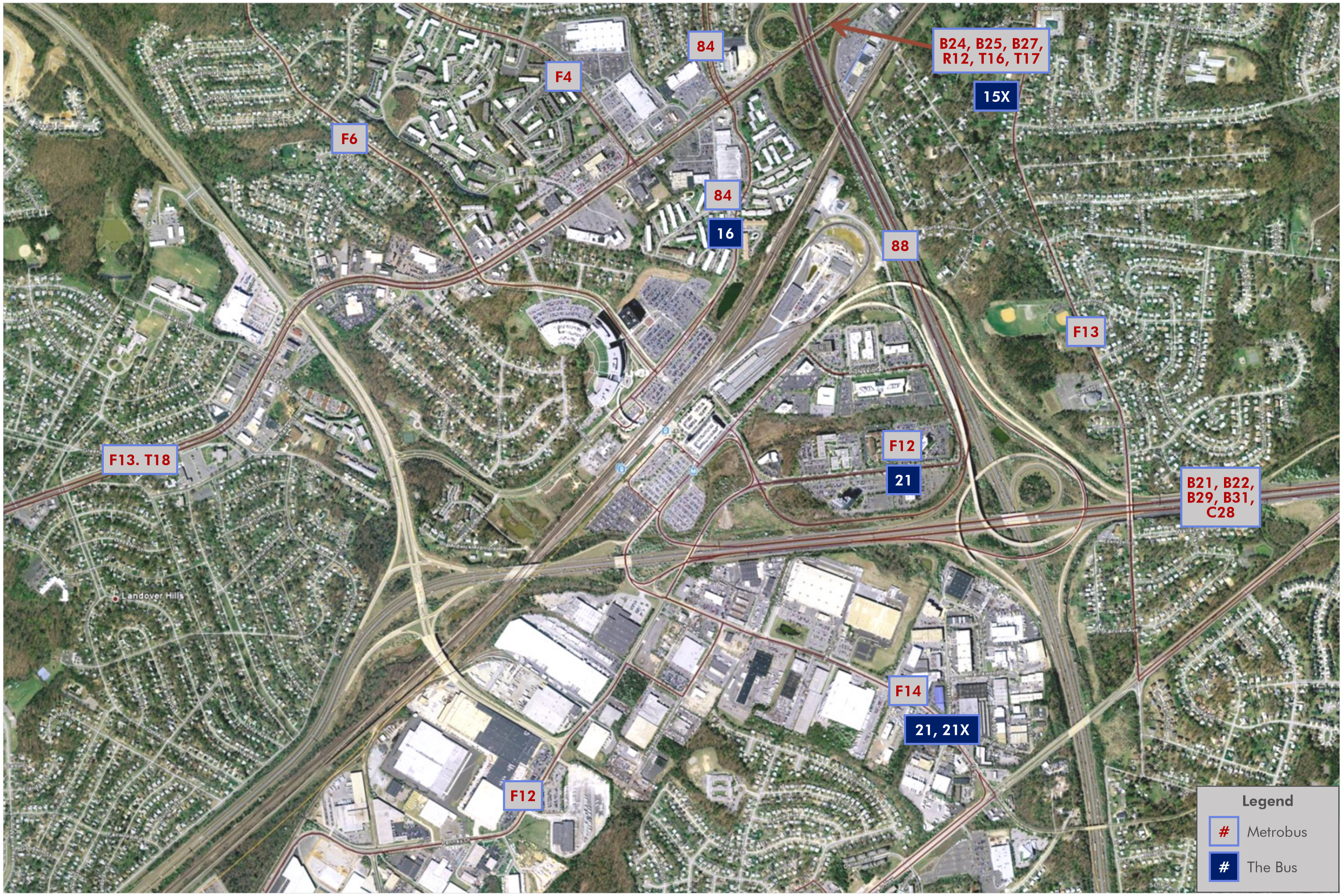


Figure 6: Bus Routes in the Vicinity of New Carrollton

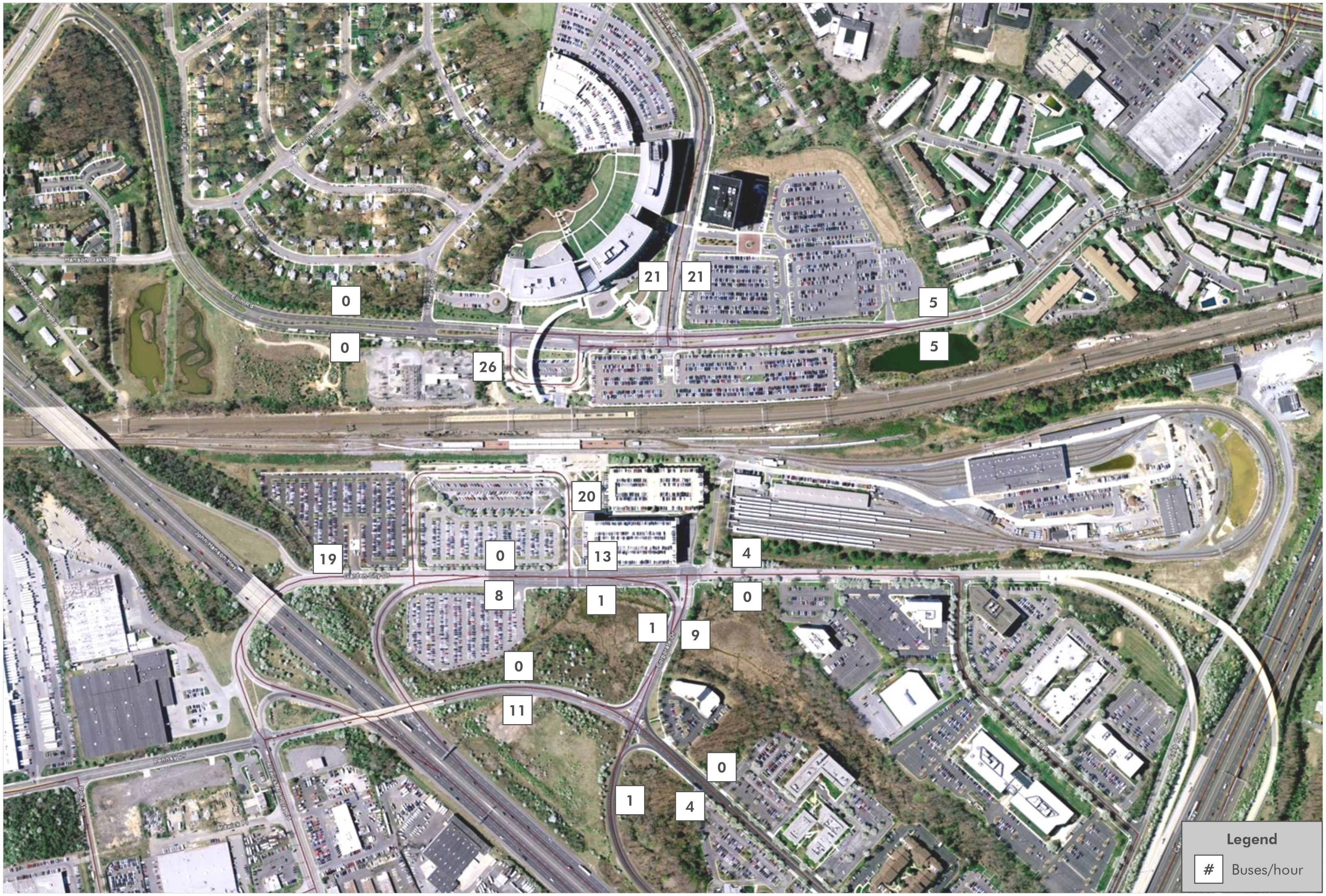


Figure 7: Bus Volumes in the Vicinity of New Carrollton

walk to the bus, demonstrating that many people ride the bus to local businesses or from nearby residences.

Bus Bay Utilization

There are four bus bays on the west side of the station and six bus bays on the east. The original design may have assumed that the growth in bus trips would be from the east, or perhaps the west side was physically constrained. Whatever the reason, bay utilization on the west side is much higher than on the east, with 26 buses per hour using four bays compared to 20 buses per hour using six bays on the east side. All bays on the west side are at 100 percent or higher utilization, creating congestion and bottlenecks that are described in the later section Assessment of Existing Conditions. East side bay utilization is generally less than 60 percent, with bay F being the only bay with a utilization greater than 60 percent. Table 8 lists the current utilization rate for each bus bay.

Utilization reflects the total scheduled time for all buses at a bay in the peak hour, including dwell time, recovery and layover time, and a small tolerance time for late arriving buses. Note that utilization rates higher than 100 percent require some buses to layover at a designated layover space rather than at the assigned bay.

Layover Locations

Buses layover in a variety of locations, some designated on-site, while others use more informal locations on Ellin Road. There are limited locations to layover on the east side because of the roadway and entrance layout. On the west side, buses are laying over in several locations that are causing congestion during peak periods. Figures 8 and 9 show the layover locations on each side of the station.

Table 7: Average Daily Bus Transfers at New Carrollton by Mode of Access

Mode	Bus Transfers	Share of Total
Walk	2,300	31%
Drove	86	1%
Passenger	65	1%
Kiss & Ride	409	5%
Taxi	40	1%
Bicycle	6	0%
Bus	2,560	34%
Metrorail	1,975	26%
MARC	49	1%
Amtrak	33	0%
Total	7,500	

Source: 2007 WMATA Bus Survey

Table 8: Existing Bus Bay Utilization

Route	Bay	Peak Hour Buses/ Hour	Total Time at Bay	Bay Utilization
West Side				
84, B24, B25, B27	G	7	87	145%
F4, F6	H	6	76	127%
R12, T16, T17	J	4	62	103%
F13, F13, T18, TB15X, TB16	K	9	86	143%
Total		26		
East Side				
B29, B31, Greyhound	A	3	27	44%
B21, B22, C28	B	4	36	60%
F14	C	2	22	37%
F12	D	4	24	40%
88, 921	E	3	17	29%
TB21, TB21X	F	5	50	83%
Total		20		

Figure 8: Layover Locations on the West Side of the Station

Figure 9: Layover Locations on the East Side of the Station

Assessment of Existing Conditions at New Carrollton Metro Station and Recommended Short-Term Improvements

East Side

Parking and Entrance Drives
Daily parking is completely full on weekdays Tuesday through Thursday. The station's proximity and easy access from US 50 and I-495 makes it very popular for commuters. Ridership models suggest there is ample demand for additional parking, and the Purple Line will increase the demand as well. The 2008 WMATA Station Access & Capacity Study forecasts a 15.5 percent increase in boardings at New Carrollton by 2030. Recent patronage model results for the Purple Line adds another 45 percent in total Metrorail and Purple Line boardings. If there is no shift in the mode of access percentages shown in Table 5, there may be demand for as many as 2,500 daily parking spaces by the year 2030. However, there is an opportunity with mixed-use development plans to increase ridership at the station through more pedestrian and bicycle trips, thereby reducing the parking mode percentage.

The east station entrance drive is the access point to the Metro garage, with three gates entering the facility. The decision point is quick after turning into the entrance drive, but most parkers are repeat customers. Signage to the garage is inadequate, however, with no signs on-street informing drivers of the garage. Signs do direct drivers to the surface lots, but the majority of parking is located in the garage.

- **Recommend** installing signage on the entrance roadway that indicates the entrance to the daily parking garage.

The entrance drive becomes congested and backs up during the AM, but clears relatively quickly because of the three gates into the parking garage and the use of SmarTrip for access that has improved the throughput markedly. The garage exits on the northeast side of the garage at the signalized intersection of Garden City Drive and Corporate Drive and therefore does not affect the entrance drive.

The east side exit drive does back up during the PM peak period, but typically clears in one to two minutes. The majority of vehicles exiting are turning right to access I-495, US 50, and Ardwick-Ardmore Drive. The exit is not signalized and doesn't appear to need it based on current volumes. Large scale development in the area, as envisioned in the Transit Development Plan, may necessitate a signal in the future.

- **Recommend** examining feasibility of striping two right-turn lanes at exit.

Figure 10: East Side Entrance Drive

Figure 11: East Side Exit Drive

Kiss & Ride Facilities

Two lanes on the east entrance drive are marked as entrances to the Kiss & Ride; however, the lanes narrow at the Kiss & Ride entrance and frequently become blocked. The taxi queue often extends out to the bus lane entrance. Kiss & Ride drivers are sometimes confused, stopping behind the taxi queue before realizing their error. Transit police were observed asking taxi drivers at the back of the queue to drive away so that the bus lane would remain clear.

The Kiss & Ride activities themselves often block the entrance drive back to the intersection with Garden City Drive, as shown in Figure 12. For example, Kiss & Ride drivers are picking up and letting out along the travel lane just inside the Kiss & Ride facility rather than pulling into designated spaces. Many drivers don't want to use pull-in/back-out spaces and simply stop in the through lanes. Additionally, the crosswalk opposite the station entrance is at the entrance to the Kiss & Ride. The result is that many of the Kiss & Ride spaces go unused while a line develops entering the Kiss & Ride as drivers pick up their passengers near the crosswalk.

- **Recommend** signage, striping, and enforcement to keeping taxi queue from extending into driving lanes.
- **Recommend** removing the first several Kiss & Ride spaces on left and signing "NO STOPPING to load/unload" on pavement.
- **Recommend** examining different layouts for Kiss & Ride that provides more curbside pickup and more pull-thru spaces.

Pedestrian Network

The pedestrian network connecting the station entrance to the parking facilities, Kiss & Ride and taxi stand, and the surrounding neighborhood works acceptably well. There are multiple paths to the parking garages, and the sidewalk network to the neighboring businesses is typically offset from the roadway with a tree-lined median, improving safety. Figure 3 provides an aerial view of the surrounding sidewalk network.

The sidewalks in front of the east side of the station entrance are crumbling and need repair. A fence has been installed to protect a grassy area from foot traffic, but people simply walk around the fence and onto the grass.

Figure 12: East Side Entrance Drive at Kiss & Ride Entrance

Figure 13: East Side Entrance Drive Congested from Kiss & Ride Activity

- **Recommend** installing sidewalk where now dead grass and remove fence.

- **Recommend** repair or replace crumbling sidewalks.

Other than the trees shown in Figure 14, there is little shade or cover near the station entrance, and no seats to use while waiting other than the bus shelters at each bus bay.

- **Recommend** installing benches and shade near the station entrance.

Bus Operations

There are several issues affecting the most efficient bus operations on the east side: inadequate layover space, relaxed operating standards, and restricted space in front of the station entrance for alighting passengers.

There are only two layover areas, both informal. One to two buses often layover on the left curb of the entrance drive, blocking the entrance lane to the surface parking lot and increasing congestion on the entrance drive. The second location is on the left lane of the exit drive. This location does not interfere with traffic but does not allow a direct view of the bus bays.

- **Recommend** training and enforcement to restrict drivers from laying over in the entrance drive.

- **Recommend** removal of security booth from left lane of exit drive and designating that lane as a temporary layover area.

Relaxed operating policies can be corrected with training and enforcement. Bus 21X was observed parking beyond the assigned shelter, waiting several minutes, then opening doors to board waiting passengers. Passengers had to wait in the heat and weren't clear when the driver opened the doors. Metro B29 was observed sitting at first bay with doors closed while line formed in hot sun to board.

- **Recommend** training and enforcement to provide better customer service.

Figure 14: Fence to Prohibit Pedestrian Activity Across Grass

Bus laying over on entrance drive. Bus laying over on exit drive.

Figure 15: East Side Layover Areas

A plan that corrects several of the issues described can be found in Figure 17. This general concept plan moves the western portion of the Kiss & Ride to the east, providing space for a lane for buses to layover. It also restricts parking at the entrance to the Kiss & Ride lot and signs the entrance against picking up passengers in the travel lane. An additional entrance lane is added by removing one row of cars on the surface parking lot.

- **Recommend** studying the feasibility of short-term station improvements.

Another issue, not addressed in Figure 17, is that the majority of buses stop along the curb in front of the station entrance to alight passengers (Figure 18). This is an informal, unsigned stop that benefits passengers by reducing their walking distance. Because the roadway curves before the station entrance, there is space for only one bus alighting without blocking bus bay A. When a bus occupies bus bay A, buses must stop in the travel lane to alight passengers or simply drive to the assigned bay and alight passengers there.

Figure 16: Poor Customer Service

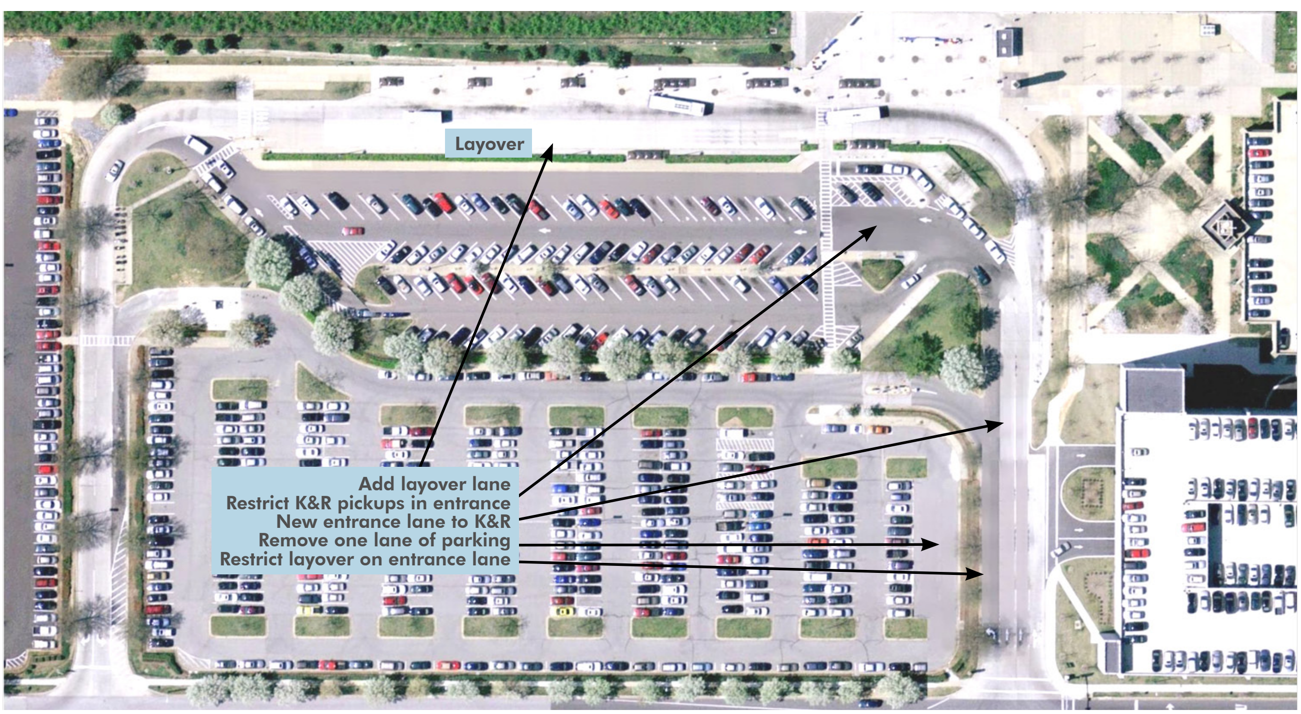


Figure 17: Potential Short-Term Reconfiguration on the East Side of the Station

Greyhound bus at Bay A blocking other buses.

Figure 18: East Side Station Entrance Curb

West Side

Parking and Entrance Drives

The west side is constrained by inadequate property depth from Ellin Road. The bus bays and Kiss & Ride were squeezed into the available space to the extent possible, but the design deficiencies and the increase in bus arrivals have exceeded the capacity of the west side.

The surface parking lot entrance is at the intersection with Ellin Road and Harkins Road, which works well. All movements in and out of the lot are signalized. This can create a small queue when exiting through the gates waiting for the light, but the use of SmarTrip and dual exit lanes limit the length of the queue. Additionally the lot is not large so the volume of autos leaving at one time remains small.

Kiss & Ride Facilities

The west side Kiss & Ride contains 24 metered midday parking spaces and eight additional pull-through spaces. As with the east side, drivers often stop in the travel lanes to pick up their passengers, blocking following traffic. Kiss & Ride vehicles are able to exit the station area via the unsignalized exit with little difficulty because traffic volumes on Ellin Road are not excessive.

Taxis queue up during the PM to the Kiss & Ride entrance and continue queuing in the curb lane of Ellin Road. There is space for approximately nine taxis on site before blocking the Kiss & Ride entrance. Some taxis park in the Kiss & Ride spaces because the queue is so long.

- **Recommend** continued enforcement of taxi queue length.

Pedestrian Network

The waiting area in front of the bus bays is small and easily becomes congested during the PM peak period as passengers exit the escalators from the Metro station and wait for buses.

There are ample sidewalks connecting the station to the adjacent businesses and neighborhoods. Most sidewalks are offset from the street by a grassing median, improving safety. Major intersections are signalized with pedestrian crosswalks. A pedestrian bridge connects the station entrance to the three IRS buildings immediately across the street.

Bus Operations

Twenty-six buses per hour are assigned to four bus bays. Utilization

Figure 19: West Side Pedestrian Network

is greater than 100 percent at all four bays, with two bays reaching 145 percent utilization. The F4 and F6, for example, share a bay with six buses per hour but an average layover time of eight minutes each. The F6 is often scheduled to depart only two minutes behind the F4. The result is that the bay is often occupied when the next bus arrives. Arriving buses will often then use another bay that in turn blocks another arriving bus. At least six bays are required to accommodate the scheduled number of buses in the peak periods.

The second major deficiency on the west side is the lack of layover space and the tendency for many buses to layover on-site. There are two designated layover spaces, marked L1 and L2 in Figure 20. The other layover spaces shown are ad-hoc, and each contributes to the congestion within the facility. When buses don't pull forward at L3, another bus in L4 will block a bus exiting bay K, forcing that bus to back up to clear the buses laying over at L3 and L4. One bus had to back up twice (backing up without a flagman is against Metrobus policy, but occurs frequently at New Carrollton) to exit bay K.

A bus laying over at L6 likewise blocks buses accessing bay G, which may have to back up to clear a bus boarding at bay H because they were not able to park parallel to the curb. This is a frequent occurrence even though buses are allowed to layover on Ellin Road.

- **Recommend** striping and signing for layover spaces on-site and eliminating layover on entrance drive. There is space along the eastbound lanes on Ellin Road to layover but it is accessible only to buses entering service from the garage. That space would be time-consuming for revenue buses to access unless a turnaround is constructed allowing buses to make a U-turn from westbound to eastbound Ellin Road.

Figure 21 shows a potential alternative layout that would solve many of the issues. The bus bays and Kiss & Ride lot are extended to the intersection of Ellin Road and Harkins Road, with the exit shared with the park & ride. Four new bus bays are added, bringing the total to

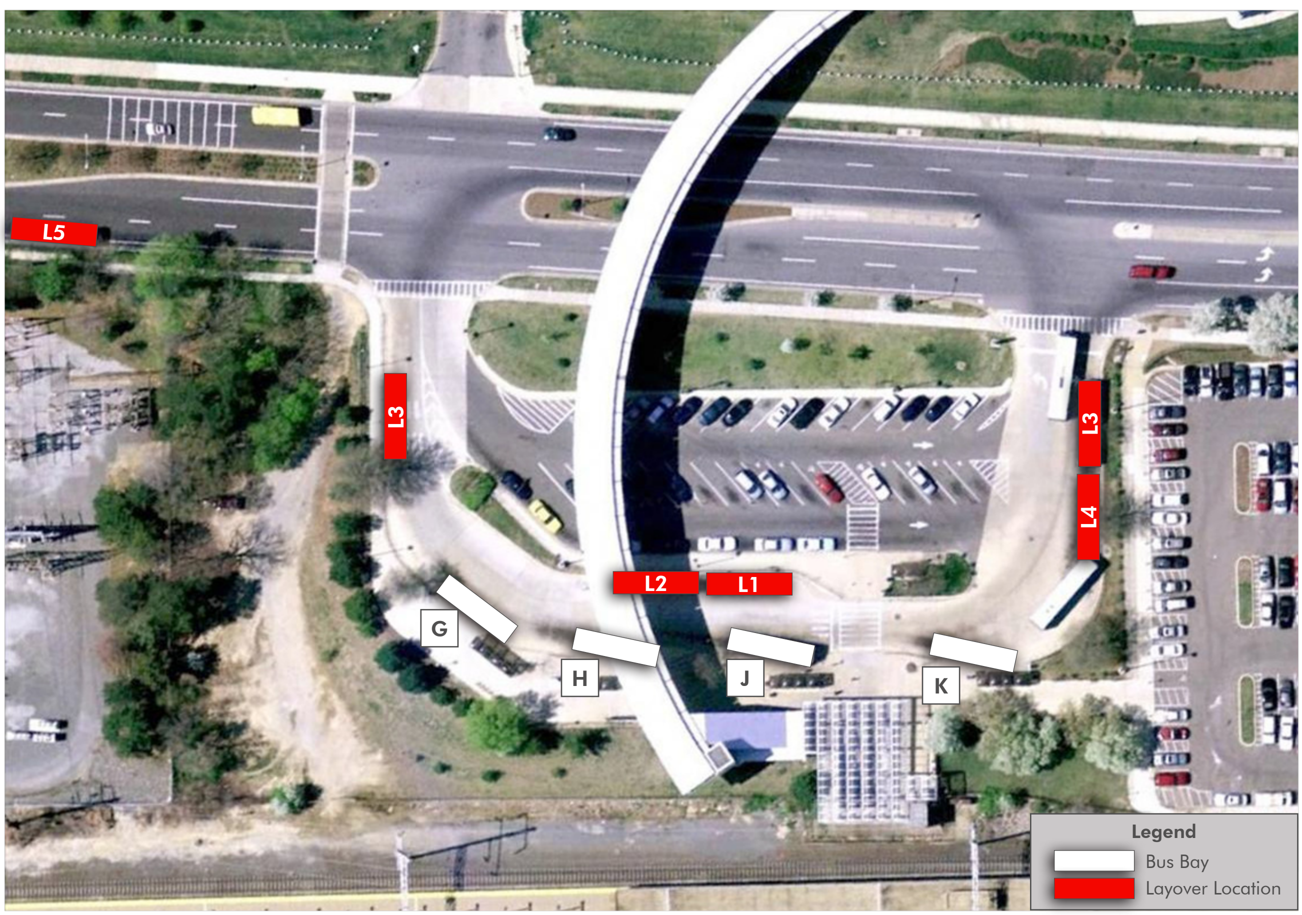


Figure 20: West Side Layover Areas

seven bays. The layover lane is also extended, accommodating as many as six buses. Laying over is restricted from the entrance and exit drives.

- **Recommend** studying the feasibility of short-term station improvements.

Endnotes

1. Source: Transit Ridership Trends and Markets report dated March, 2009 and ridership statistics from 2008, 2009 and 2010

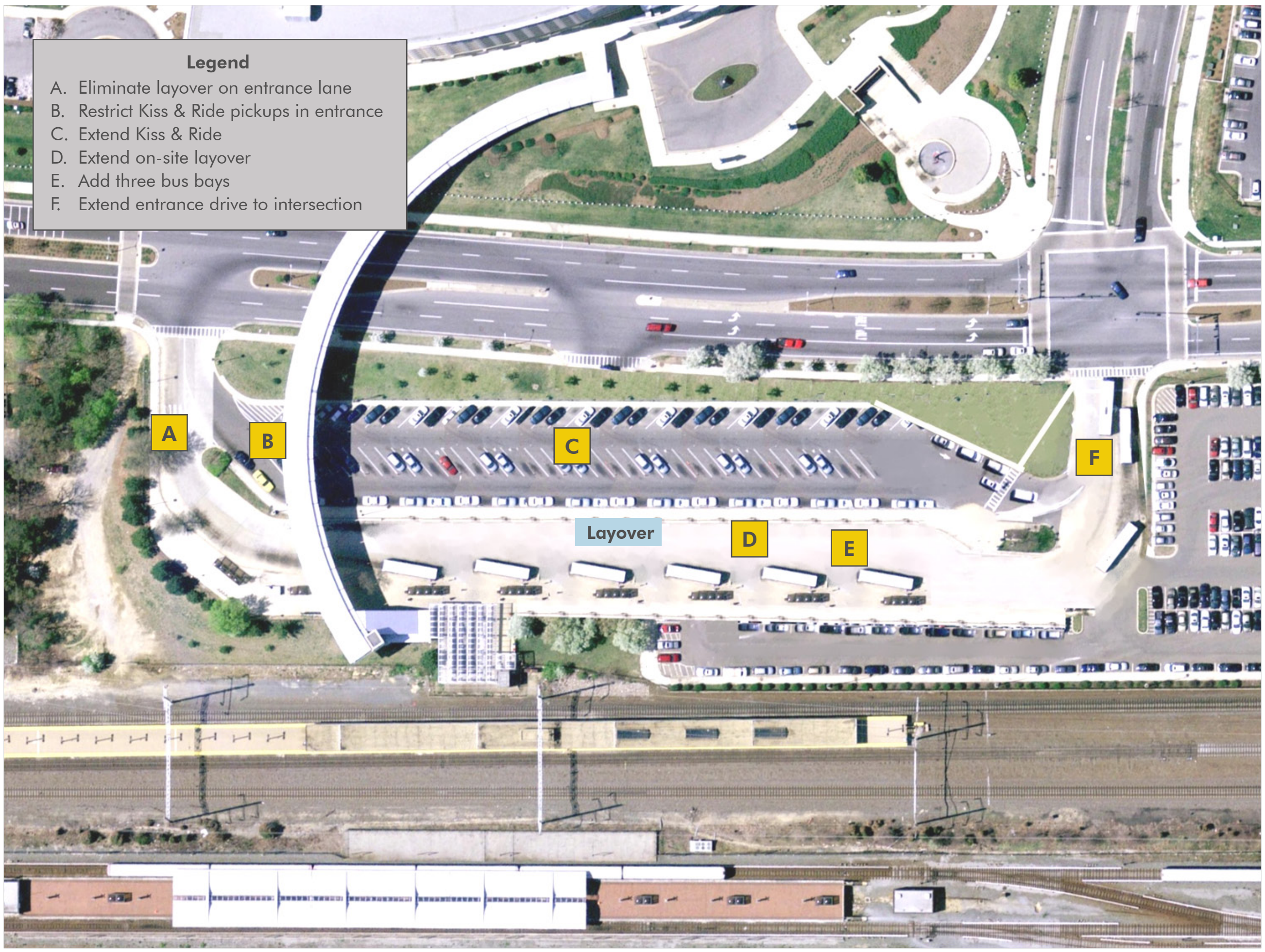
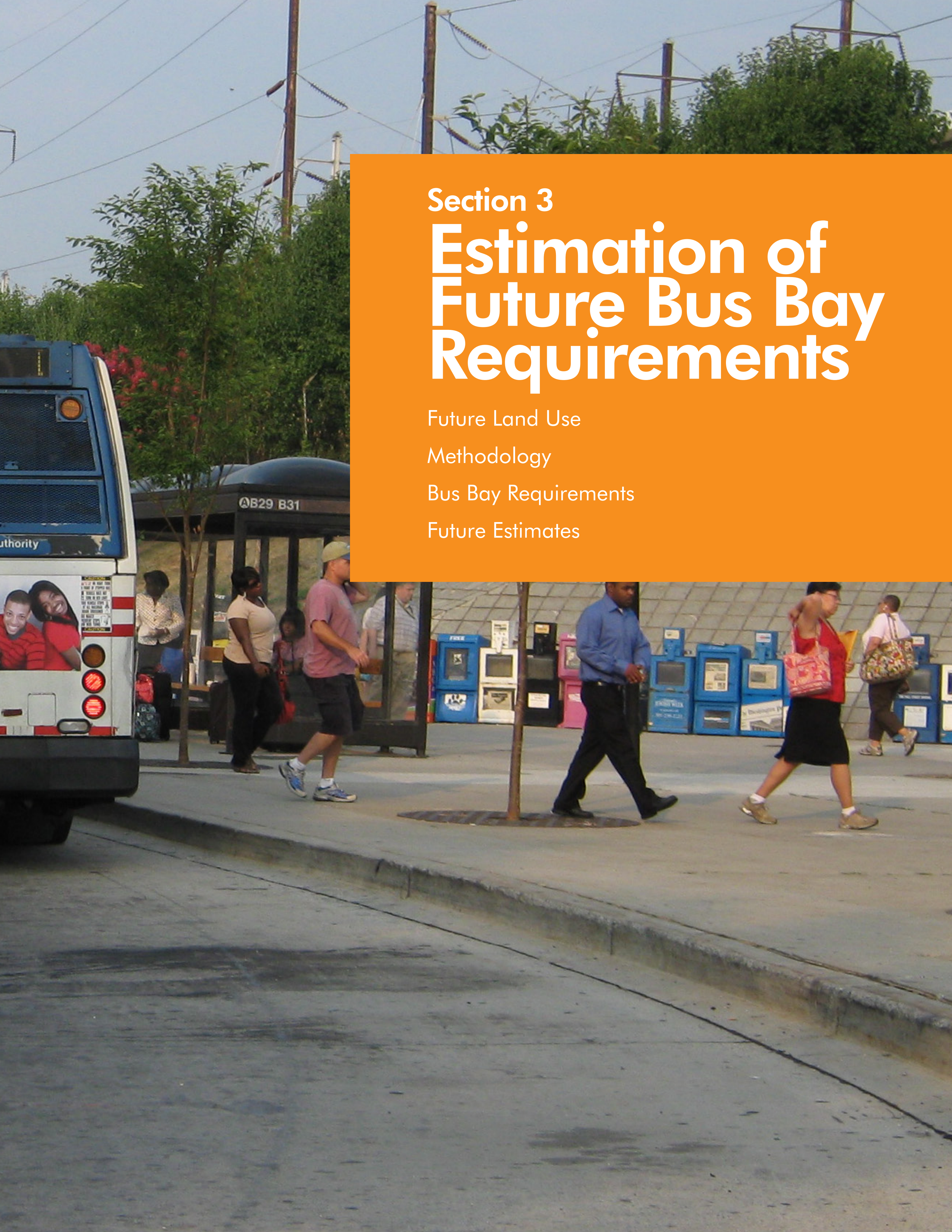


Figure 21: Potential Short-Term Reconfiguration on the West Side of the Station


9488
SAFE SUMMER
make late nights great nights more!
2004
F14
2001
STOP



Section 3

Estimation of Future Bus Bay Requirements

Future Land Use

Methodology

Bus Bay Requirements

Future Estimates

Estimate of Future Bus Bay Requirements

The number of bus bays required at a station is a result of several factors:

- Maximum number of buses at the station at the same time, which is a function of:
  - Number of bus routes serving the station,
  - Frequency of each bus route (number of buses per period of time), and
  - Length of time each bus remains at the bay
- Bay assignments, which may be a function of:
  - Geographical area served and/or direction of travel, and
  - Frequencies and schedules that allow multiple routes to share the same bay. Frequencies of multiple routes serving a shared bay should be of the same time increment, with schedules that allow those routes to alternate arrivals.
- Future growth, which affects the number and frequency of routes, which in turn affects the ability to share bays.

To determine the number of bus bays required at the New Carrollton Metrorail station in year 2035, a methodical approach was used to examine the maximum load point volumes for all bus routes serving the station, and assigning routes to bays based on similar market area and/or similar headways.

Bus frequencies are based on policy headways or the maximum load point volume, whichever is more frequent. The maximum passenger loading along any bus route, divided by the passenger loading standard, provides the minimum frequency required to provide comfortable loading on the vehicle. A comfortable loading standard for peak periods is between 40 to 55 passengers for a 40-foot bus, allowing for variation of passenger volumes during the peak period and a reasonable number of standees that still allows passengers to board and alight with ease. For this study, the vehicle loading standard selected by the study team is 40 persons per vehicle, which allows standees on some buses without heavier loads which would make boarding and alighting difficult.

A simple example of maximum load point volume is shown in Figure 22, with the maximum load point between stops E and F with 80 passengers per hour. With a loading standard of 40 passengers per bus, the minimum frequency required to serve this load is two buses per hour or a 30-minute headway.

The methodology used to determine the number of bus bays required in the future at New Carrollton followed these steps:

1. Determine the number of existing bus trips to/from New Carrollton station and the average time at the bay for each route.
2. Determine the utilization of each bay, the amount of time the bay is occupied during the peak period.
3. Determine the number of passenger boardings and alightings by route at New Carrollton.
4. Determine the existing vehicle loadings at the maximum load point in the peak hour for each route. This will help determine how much excess capacity exists.
5. Develop a new land use scenario based on the New Carrollton Preliminary Transit District Development Plan (TDDP) and allocate forecasted population and jobs to sub-areas within the two transportation analysis zones (TAZ) on either side of the New Carrollton Metrorail station.
6. Determine the percent increase in future Metrorail, Metrobus, and The Bus boardings and alightings at New Carrollton from the MWCOG travel demand model.

Figure 22: Passengers per Peak Hour

Stop	A		B		C		D		E		F		G		H		I		J
On	15		23		17		25		15		8		5		2		3		0
Load	------	15	------	36	------	48	------	70	------	80	------	61	------	34	------	20	------	10	------
Off	0		2		5		3		5		27		32		16		13		10

7. Confirm vehicle capacity and loading standards. What size buses will The Bus and WMATA use in the future for each route?

8. Determine new max load point volumes for each bus route serving New Carrollton using two methods: 1) from results of the travel demand model, and 2) from the WMATA 2005 Development-Related Ridership Survey.

9. Determine new headways based on max load point volumes and vehicle capacity.

10. Determine future bus bays requirements based on future headways.

11. Assign routes to bays based on markets served and shared headways.

12. Include one additional bay on each side of the station for contingencies or as a drop-off bay.

Future Land-Use

On May 4, 2010, the Prince George's County Council approved the New Carrollton Preliminary Transit District Development Plan (TDDP) and Transit District Overlay Zoning (TDOZ) Map Amendment. The new plans envision a high-density, mixed-use urban center. The TDDP includes four plan areas which are bounded by Annapolis Road, Interstate 495, John Hanson Highway, and Veterans Parkway. The plan anticipates over five million square feet of new office/retail/hotel/entertainment space and up to 5,500 new residential units with the Metro Core, one of the four plan areas, containing the highest density with approximately 2.5 million square feet of this new development along with up to 3.000 new residential units. The TDDP vision for development of the Metro Core area includes high-intensity transit-oriented development, walkable, with active ground-floor uses and direct visual connection to adjacent streets. The County envisions a renovated Metro station as a centerpiece of a new downtown location.

These future build-out densities are not incorporated in the MWCOG demographic forecasts at this time. To develop the new forecasts of population and jobs within walking distance of the Metro station, the full build-out densities were allocated to the two TAZs on either side of the station.

Allocation of Projected TDDP Population and Jobs

The two TAZs surrounding the New Carrollton station, and that make up the TDDP boundary area, are zones 698 and 699 as shown in Figure 23.

The TDDP (Figure 24) describes the expected build-out of four sub-areas.

- Metro Core: 2,600,000 square feet of commercial office space, 100,000 square feet of retail space, and 3,000 residential units
- Annapolis Road Corridor: 1,000,000 square feet of community-serving retail space, 500,000 square feet of commercial office space, and 1,000 residential units.
- Garden City: 1,400,000 square feet of office space, 500,000 square feet of retail space, and 1,500 residential units
- North Hillside: 1,500 additional dwelling units, 40,000 square feet of

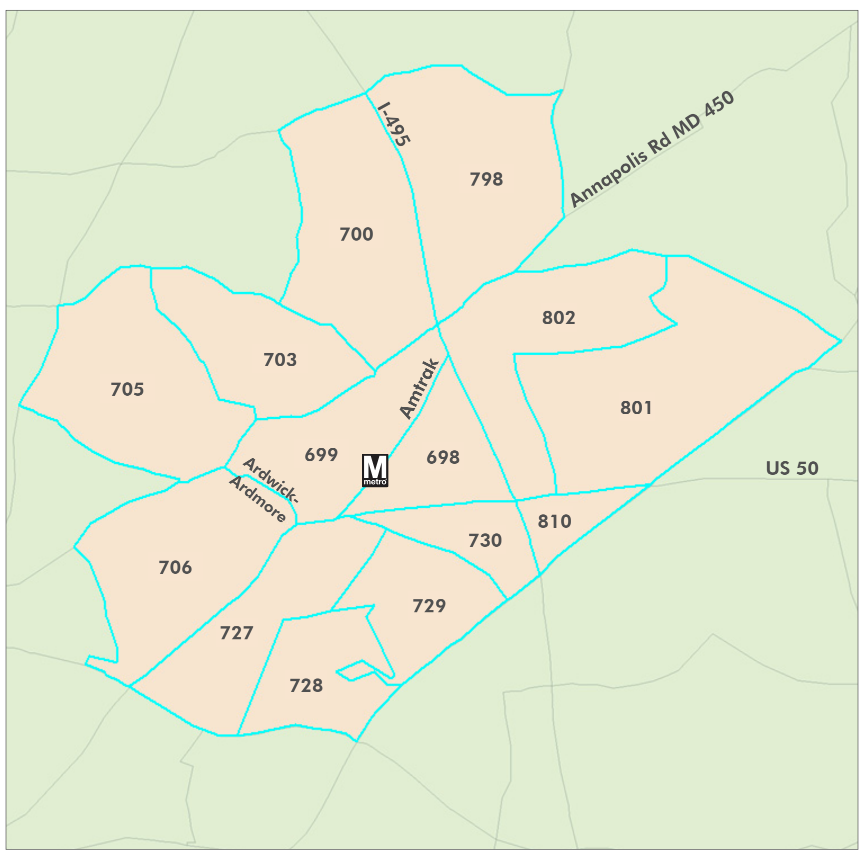


Figure 23: TAZs in Proximity to the New Carrollton Metrorail Station

retail space, and 40,000 square feet of commercial office space.

The TDDP data was allocated to TAZ 698 and 699 in the following manner:

1. Data for TAZs 698 and 699 were extracted from the MWCOG Cooperative Forecasts Round 7.2A for years 2010 through 2030, as shown in Table 9.

2. The TDDP projection for the number of households and retail and office construction were used to develop estimates of population and employment based on common rates, as shown in Table 10. For population, the MWCOG average 2030 household size for these two zones of 2.7 persons per household was multiplied by the projected build-out of 7,000 residential units to derive a population of 18,900 persons. For retail and office construction, industry rates of 550 square feet per employee[1]

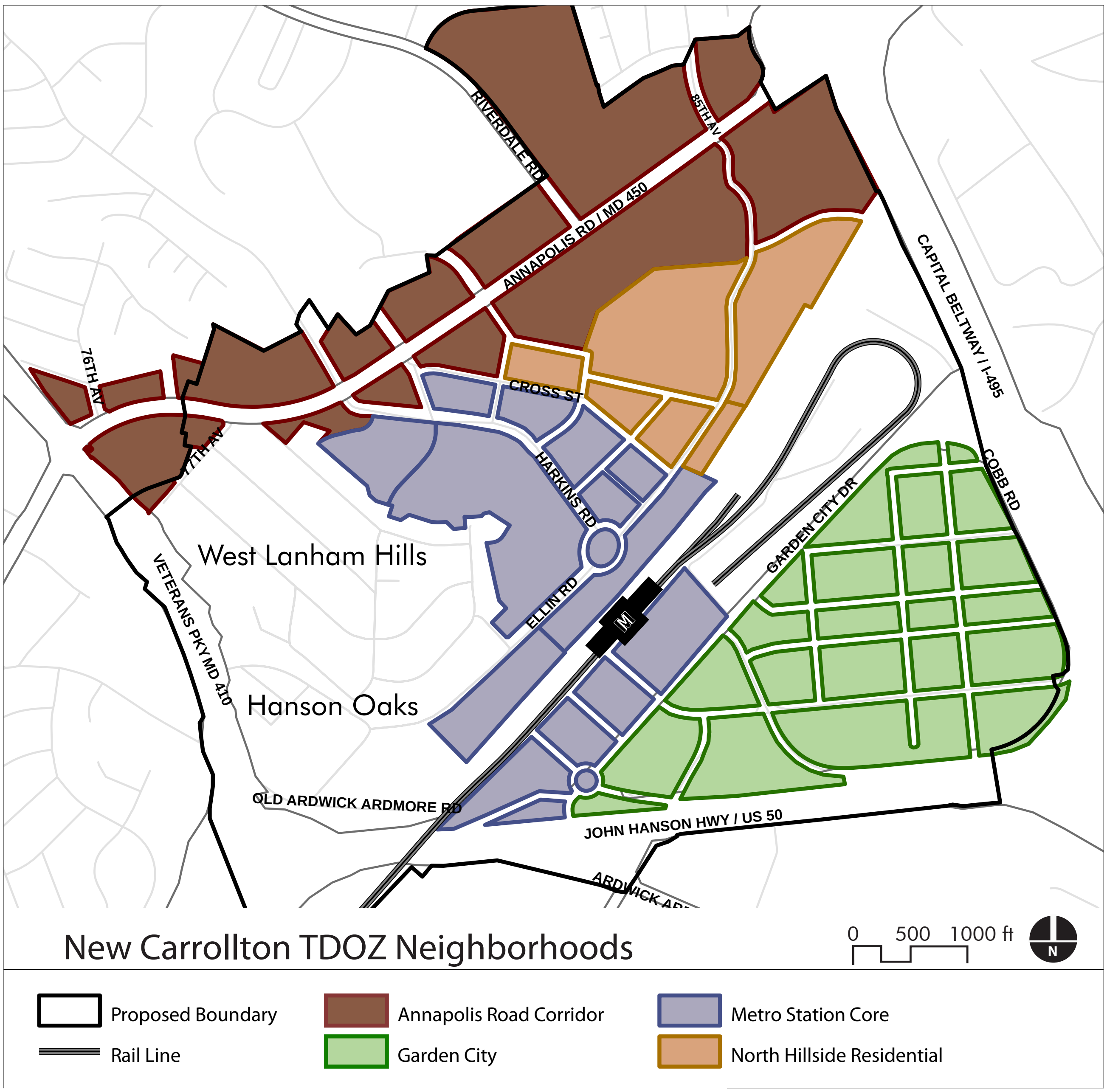


Figure 24: New Carrollton TDOZ Neighborhoods

Source: New Carrollton Transit District Development Plan

Table 9: MWCOG Round 7.2A Demographic Forecasts for New Carrollton

Data Year	TAZ	Area	Households	Household Population	Employment					Population/ Household
					Total	Industrial	Retail	Office	Other	
2010	698	0.37	0	0	3,633	714	1,063	642	1,214	
	699	0.56	1,343	3,678	5,870	820	546	2,219	2,285	2.7
Total		0.93	1,343	3,678	9,503	1,534	1,609	2,861	3,499	
2015	698	0.37	0	0	3,705	728	1,085	655	1,237	
	699	0.56	1,344	3,641	5,970	833	554	2,258	2,325	2.7
Total			1,344	3,641	9,675	1,561	1,639	2,913	3,562	
Change from 2010			0%	-1%	2%	2%	2%	2%	2%	
2020	698	0.37	62	179	3,807	747	1,115	673	1,272	2.9
	699	0.56	1,954	5,200	7,230	1,009	671	2,735	2,815	2.7
Total			2,016	5,379	11,037	1,756	1,786	3,408	4,087	
Change from 2010			50%	46%	16%	14%	11%	19%	17%	
2025	698	0.37	165	469	3,933	773	1,150	696	1,314	2.8
	699	0.56	2,215	5,828	8,590	1,200	797	3,249	3,344	2.6
Total			2,380	6,297	12,523	1,973	1,947	3,945	4,658	
Change from 2010			77%	71%	32%	29%	21%	38%	33%	
2030	698	0.37	293	825	4,121	810	1,205	729	1,377	2.8
	699	0.56	2,436	6,365	9,890	1,381	917	3,741	3,851	2.6
Total			2,729	7,190	14,011	2,191	2,122	4,470	5,228	
Change from 2010			103%	95%	47%	43%	32%	56%	49%	

Table 10: Estimate of TDDP Population and Employment (Maximum Build-Out)

Neighborhood	Retail Development (sq. ft.)	Office Development (sq. ft.)	Retail Employees (sq. ft./empl.)	Office Employees (sq. ft./empl.)	Households	Household Population	Retail Employment	Office Employment
Metro Core	100,000	2,600,000	550	368	3,000	8,100	182	7,065
Annapolis Road Corridor	1,000,000	500,000	550	368	1,000	2,700	1,818	1,359
Garden City	500,000	1,400,000	550	368	1,500	4,050	909	3,804
North Hillside Residential	40,000	40,000	550	368	1,500	4,050	73	109
Total	1,640,000	4,540,000			7,000	18,900	2,982	12,337

Note: Annapolis Rd Corridor allocated 40%in TAZ 699. The remaining portion of that corridor lies within other TAZs and is greater than ½-mile walking distance.

and 368 square feet per employee[2] were used for retail and office respectively, resulting in 2,982 retail and 12,337 office jobs for the TDDP boundary area.

3. These projections for population and employment were allocated to each TAZ based on the size of the neighborhood within each TAZ, as shown in Table 11. Approximately 25 percent of the Metro Core is within TAZ 698, with the remaining 75 percent within TAZ 699. About 40 percent of the Annapolis Road Corridor lies within TAZ 699. The remaining portion of the Annapolis Road Corridor lies within other zones not within a ½-mile walking distance to the station. All of Garden City resides within TAZ 698, and all of the North Hillside area resides within TAZ 699. TAZ 699 also includes several neighborhoods to the southwest not included in the TDDP.

4. The resulting 2030 population and employment for TAZs 698 and 699 are shown in Table 12. All are based on the allocations shown, except TAZ 699 which also includes 50 percent of the original Round 7.2A population and retail employment (shown in Table 9) that represents the neighborhoods to the southwest of the TDDP boundary area.

Table 11: Allocation of TDDP Population and Employment (Maximum Build-Out)

Neighborhood	Allocation	
	TAZ 698	TAZ 699
Metro Core	25%	75%
Annapolis Road Corridor	0%	40%
Garden City	100%	0%
North Hillside Residential	0%	100%

Table 12: Revised TAZ Population and Employment for Land-Use Scenario 1

Data Year	TAZ	Area	Households	Household Population	Employment				
					Total	Industrial	Retail	Office	Other
2030	698	0.37	2,250	6,075	8,712	810	955	5,571	1,377
	699	0.56	4,822	13,044	12,392	1,381	1,209	5,951	3,851
Total			7,072	19,119	21,105	2,191	2,164	11,522	5,228
Change from 2010			427%	420%	122%	43%	34%	303%	49%

Methodology

Two methods were used to estimate the number of passenger trips using bus at New Carrollton:

1. The MWCOG travel demand model was run using revised demographic forecasts for the two Transportation Analysis Zones (TAZ) surrounding the New Carrollton station, and the percent change in passenger trips using bus from the 2010 and 2030 model runs were applied to existing bus passenger trips to derive estimates of future ridership.

2. Data from the 2009 WMATA Transit Ridership Trends and Markets was used to estimate the number of passenger trips using bus at New Carrollton.

MWCOG Travel Demand Model

This method consisted of three steps:

- Allocate the projected TDDP population and jobs to the two TAZs surrounding the New Carrollton station (described previously).
- Run the model and report passenger trips on bus and rail.
- Factor existing bus passenger trips based on the percent change shown in the model from 2010 to 2030.

Table 13 summarizes the results of the travel demand model runs. Metrorail boardings at New Carrollton increase 15 percent between 2005 and 2030 No-Build and 46 percent between the No-Build and the 2030 full build-out land use allocation. Bus boardings are forecasted to increase at a higher rate in the 2030 No-Build, 33 percent overall, with a similar amount to Metrorail in the full build-out, 43 percent.

The higher bus passenger volumes are likely due to constrained parking at New Carrollton, with more passengers using bus to access the station. The reason why bus boardings do not increase significantly between the No-Build and the Full Build-Out may be due to the gravity formula used in the travel demand model. Person trip distribution uses a gravity model whereby trips are proportional to the size and distance between productions (residents) and attractions (e.g., jobs, shopping).

Because the full build-out at New Carrollton includes a large increase in household population, a larger share of jobs at New Carrollton are expected to be filled by those nearby residents, resulting in only a small increase in bus boardings. This is one of the desired effects of mixed-use development, reducing overall travel. Much of the increased transit travel to New Carrollton is expected to be carried by Metrorail, which provides access to a larger market of employees and employers than the feeder bus lines.

Transit Mode Share at Metrorail Stations

[Please note that the following discussion refers only to boardings and alightings of passengers who live or work in the New

Table 13: Travel Demand Model Results for 2030 No-Build and Full Build-Out

Category	2005	2030 No Build	2030 Purple Line	2030 Full Build-Out
Metrorail Boardings				
Total	7,005	8,070	8,570	10,238
Change from 2005	-	15%	22%	46%
Bus Boardings (entire route)				
West Side of Station	9,870	14,610	14,130	14,640
Change from 2005	-	48%	43%	48%
East Side of Station	5,220	5,460	6,530	6,880
Change from 2005	-	5%	25%	32%
Total of Both Sides	15,090	20,070	20,660	21,520
Change from 2005	-	33%	37%	43%
Maximum Load Point				
West Side of Station	6,530	9,060	8,850	8,980
Change from 2005	-	39%	36%	38%
East Side of Station	4,690	4,550	5,380	5,720
Change from 2005	-	-3%	15%	22%

Metrorail peak headways: 2005 = 6 minutes; No Build = 7 minutes; Full Build-Out = 4.6 minutes

Carrollton area, and does not include passengers who take a bus from outside the area to transfer to Metrorail, which is handled separately.]

WMATA has conducted surveys of local residents and office workers in the vicinity of Metrorail stations several times during the history of the system, the last time in 2005. These surveys are intended to shed light on the share of those residents and workers taking transit (mode share). As stated in the 2005 survey, the results vary considerably from one station to another, one area to another. Although New Carrollton was included in the study, only one distant office building agreed to participate. The percentages and ratios used in this exercise were therefore obtained from the generalized results of the survey.

Table 14 shows the estimated increase in bus activity based on data from the 2005 Development Related Ridership Survey.

Bus boardings and alightings at New Carrollton today, for passengers who originate or are destined there, are higher than the average for the stations included in the Development Related Survey. Using the averages from the stations included in the 2005 Development Related Survey, without regard to existing mode shares, Table 14 estimates that bus boardings and alightings are estimated to increase by 45 percent.

The application of the 2005 survey of development related mode share applied only to bus trips that walked to or from the New Carrollton area. It did not include passenger trips on buses transferring to Metrorail or another bus. To determine the impact on total bus boardings at New Carrollton, the factors derived above have to be applied to walk access trips and then added to the non-walk trips. Table 15 summarizes the resulting change in total bus route boardings and alightings.

The limitation of this method is that it does not account for changes in bus passenger volumes away from New Carrollton station, while the results of the travel demand model do account for that change.

Bus Bay Requirements

Existing Conditions

Vehicle Loadings, Dwell Times, and Interlining

- Most WMATA bus routes are carrying about 70 percent of their maximum loads, with F4 and T18 near maximum capacity at current headways (see Appendix Figure A3: Average Vehicle Loading).

Table 15: Total Boardings and Alightings

Category	2010	2030 Full Build-Out
% Increase in Daily Walk Access Bus Trips from New Carrollton		12%
% Increase in Daily Walk Access Bus Trips to New Carrollton		80%
Daily Walk Access Bus Trips from New Carrollton	1,870	2,094
Daily Walk Access Bus Trips to New Carrollton	1,810	3,258
Daily Bus Boardings	4,390	4,614
Daily Bus Alightings	3,290	4,738
Total	7,680	9,352
% Change in Total Boardings: 2005 to 2030 Full Build-Out		22%

Table 14: Estimate of Passenger Trips based on WMATA 2005 Development Related Ridership Survey

TDDP Development	Households	Household Population	Employment					Bus Mode Share		Bus Trips	
			Total	Industrial	Retail	Office	Other	Residential	Office	Residential	Employment
Metro Core	3,000	8,100	7,466	81	182	7,065	138	7%	18%	1,134	1,416
Annapolis Rd Corridor	1,000	2,700	6,253	1,243	1,000	544	3,466	4%	6%	189	689
Garden City	1,500	4,050	6,682	729	909	3,804	1,239	4%	11%	354	1,032
North Hillside Residential	1,500	4,050	705	138	73	109	385	5%	9%	425	112
Total	7,000	18,900	21,105	2,191	2,164	11,522	5,228			2,103	3,250
								Total Daily Bus Trips			5,352
								% Change from 2005 (Res. & Emp.)		12%	80%
								Absolute Change from 2005			1,672
								% Change from 2005			45%

Note: Bus and rail rates based on WMATA 2005 Development Related Ridership Survey

- The four The Bus routes serving New Carrollton are carrying about 60 percent of their maximum loads.

- Most WMATA and The Bus routes terminate at the station, resulting in long dwell times and increasing bay utilization.

Bus Bay Utilization (Figure A2, Appendix)

Bus bay utilization is a measure of the time buses occupy the bay per unit of time, in this case per hour. It includes the time a bus occupies the bay while boarding and alighting passengers, any recovery time in the schedule for variation in travel time, scheduled layover time until the next departure, and a tolerance for normal variability of arrival time, two minutes for through routes and four minutes for terminating routes, to minimize the bay being occupied when the next scheduled bus arrives.

West Side

- All four bays are fully utilized during peak periods. As described in the Assessment of Existing Conditions, the congested bays are exacerbated by the number of buses laying over in the entrance and exit lanes.
- Six bays are needed on the west side to accommodate existing demand.

East Side

- Two bays are over 50 percent utilized today, with the remaining four bays being utilized between 29 and 44 percent during peak periods.
- Four bays are needed on the east side to accommodate existing demand.

Future Estimates

The major determinant of the number of bus bays is the average length of time each bus remains at the bay. Normal practice is for buses operating on routes that terminate at a station to layover at the assigned bay, schedule permitting. Tight schedules or sharing of bays may require buses to layover at another location on or off-site. Turnover rates at bays with terminating buses generally average six to seven buses per hour.

Through buses generally remain at a bay for a short time, enough to board and alight. Turnover rates at bays with through buses can be as high as 15+ buses per hour, though at those rates a spare bay is desirable for times when more than one bus arrives within a two-minute window. High volume on-street bus stops typically provide additional length for this reason. Only two of the routes, one on the west side (F13) and one on the east side (F12), are through routes.

Three scenarios were tested:

1. 2030 with Purple Line and current demographic projections, using travel demand results for each route.

2. 2030 with Purple Line and full build-out, using travel demand results for each route.

3. 2030 with Purple Line and full build-out, with 46 percent increase in bus boardings for every route.

In all three cases 13 bays are required, with eight bays on the west side and five bays on the east side. Routes could be assigned similar to that shown in Table 16.

Appendix A provides the calculations for bus bay requirements following the methodology outlined previously.

Table 16: Future Bay Utilization

Route	Bay Number	Peak Hour Buses/ Hour	Total Time at Bay	Bay Utilization
West Side				
84, T18	1	6	60	100%
B24, B25	2	4	42	70%
B24, B25	3	4	42	70%
B27, F4	4	4	46	77%
F6	5	5	50	83%
R12	6	4	56	93%
F13, T16, T17	7	4	34	57%
TB15X, TB16	8	4	36	60%
East Side				
88, B21, B22, Greyhound	9	5	38	63%
B29, B31, C28	10	4	38	63%
F12	11	6	36	60%
F14, 921, Greyhound	12	5	53	88%
TB21, TB21X	13	6	42	70%

Endnotes

1. Food Service average from http://www.eia.doe.gov/emeu/consumptionbriefs/cbecs/pbawebsite/retailserv/retserv_howmanyempl.htm
2. Space and Project Management Benchmarks, 2007, International Facility Management Association.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Appendix

Appendix A: Calculation of Future Bus Bay Requirements

Appendix A: Calculation of Future Bus Bay Requirements

Figure A1:

1. Existing peak hour headways and dwell times were entered from data provided by WMATA and The Bus. All routes include a minimum dwell time of one minute. Any scheduled time over one minute was entered as recovery time. Any scheduled time over six minutes was entered as layover time.

   Bays required at New Carrollton calculation:

   ((Total Time at Bay per Bus + Tolerance Time) * Buses per Hour) / 60

2. Tolerance time = time between departure of a bus and arrival of next bus.

3. Actual ride check data from WMATA and The Bus was entered for Maximum Load Point Volume and Boardings and Alightings. Where data was not available, shown in italics, data from similar New Carrollton routes were used.

Figure A2:

4. Existing bay utilization consists of the aggregate time for all scheduled buses. Utilization greater than 100 percent requires some buses to layover at on or off-site designated spaces.

Figure A3:

5. Maximum Load Point Vehicle Loadings were determined by dividing the Maximum Load Point Volumes by the number of bus trips per period. The ride check data is aggregated by time period so these loadings reflect an average over the four-hour peak period.

6. Average Peak Hour Volume = the higher of the two peak period Average Vehicle Loading multiplied by the number of Peak Hour Buses per Hour. This is used later to estimate future peak hour passengers.

Figure A4:

7. 2030 No-Build with Purple Line: the original maximum loads on Figure A3 multiplied by the growth rate for each route from the travel demand model.

8. Peak Hour Buses/Hour = the Average Peak Hour Passenger Volume divided by the Vehicle Loading Capacity.

9. Future Bays Required at New Carrollton is estimated using the following calculation:

   ((Total Time at Bay per Bus + Tolerance Time) * Buses per Hour) / 60

   An additional bay is added to each side for contingency.

Figure A5:

10. 2030 Full Build-Out: This page is identical to Figure A4 but with the full build-out of the TDDP population and employment.

Figure A6:

11. This page is identical to Figure A5 but with a 46 percent growth from 2010 to 2030 reflecting the overall increase in passenger activity at New Carrollton expected by the MWCOG travel demand model. Yet the results are the same as with individual route changes.

Figure A1: Future Bus Bay Requirements

	Minutes
Dwell Time (minimum)	1
Tolerance for terminating buses (time between buses at a bay)	4
Tolerance for thru buses (time between buses at a bay)	2

	Bus Routes Serving New Carrollton Metrorail Station 2010						Actual Counts 2010					
Route	Peak Hour Headway	Peak Hour Buses/Hour	Average Recovery Time	Average Layover Time	Average Total Time at Bay	Bays Required at NC	NC Daily Boardings	NC Daily Alightings	2010 AM Max Load Point Pass Volume	2010 NC AM Boardings	2010 NC AM Alightings	2010 PM Max Load Point Pass Volume
West Side	*min*		*min*	*min*	*min*		*pass*	*pass*	*pass*	*pass*	*pass*	*pass*
84	20	3.0	5	5	11	0.8	202	273	196	13	155	178
B24/B25	30	2.0	5	2	8	0.4	213	193	157			142
B27	30	2.0	4		5	0.3	122	84	90			62
F4	15	4.0	5	4	10	0.9	612	606	446	105	276	511
F6	30	2.0	5		6	0.3	225	230	108	62	66	147
F13	30	2.0			1	0.1	159	139	75	75	115	65
R12	30	2.0	5	7	13	0.6	190	241	157	78	109	186
T16/T17	30	2.0	5	4	10	0.5	439	393	165		140	138
T18	15	4.0	5	3	9	0.9	557	402	391	76	154	370
TB15X	80	0.8	5		6	0.1	37	37	22			22
TB16	30	2.0	5		6	0.3	210	210	124			124
Subtotal		**26**				**5.2**	**2966**	**2808**		**409**	**1,015**	
East Side												
88	45	1.3			1	0.1	44	62	100	0	62	100
B21/B22	30	2.0	4		5	0.3	270	218	198			160
B29/B31	30	2.0	5		6	0.3	130	131	96			96
C28	30	2.0	4		5	0.3	200	224	131			147
F12 thru	30	2.0			1	0.1	74	16	75			75
F12 terminate	30	2.0	4		5	0.3						
F14	30	2.0	5	1	7	0.4	286	335	109			128
921	45	1.3	5		6	0.2			120			120
TB21	30	2.0	5		6	0.3	250	250	148			148
TB21x	20	3.0	5		6	0.5	215	215	127			127
Greyhound	90	0.7	5		6	0.1			40			40
Subtotal		**20**				**2.9**	**1469**	**1451**		**0**	**62**	
Total		**46**				**10.0**	**4435**	**4259**		**409**	**1,077**	

includes 1 spare bay

Figure A2: Future Bus Bay Requirements

	Minutes
Dwell Time (minimum)	1
Tolerance for terminating buses (time between buses at a bay)	4
Tolerance for thru buses (time between buses at a bay)	2

Existing Bus Bay Utilization

Route		Peak Hour Buses/Hour	Total Time at Bay	Bay Utilization
West Side				
84,B24,B25,B27	G	7	87	145%
F4,F6	H	6	76	127%
R12,T16,T17	J	4	62	103%
F13,T18,TB15x,TB16	K	9	86	143%
		26		
East Side				
B29,B31,Greyhound	A	3	27	44%
B21,B22,C28	B	4	36	60%
F14	C	2	22	37%
F12	D	4	24	40%
88,921	E	3	17	29%
TB21,TB21x	F	5	50	83%
		20		

Utilization greater than 100% requires some buses to layover at designated layover space

Figure A3: Future Bus Bay Requirements

	Max Load Point Veh Loadings 2010				2010
Route	AM Number of Trips	AM Average Vehicle Loading	PM Number of Trips	PM Average Vehicle Loading	Average Peak Hour Passenger Volume
West Side		***pass***		***pass***	***pass***
84	7	28	7	25	84
B24/B25	5	31	6	24	63
B27	4	22	5	12	45
F4	10	45	11	46	186
F6	8	14	6	25	49
F13	6	13	5	13	26
R12	6	26	6	31	62
T16/T17	6	28	6	23	55
T18	10	39	9	41	164
TB15X	3	7	3	7	5
TB16	6	21	6	21	41
Subtotal					
East Side					
88	3	33	3	33	44
B21/B22	6	33	6	27	66
B29/B31	4	24	5	19	48
C28	6	22	6	25	49
F12 thru	5	15	5	15	30
F12 terminate	5	0	5	0	0
F14	7	16	5	26	51
921	4	30	4	30	40
TB21	6	25	6	25	49
TB21x	6	21	6	21	64
Greyhound	2	20	2	20	13
Subtotal					
Total					

Figure A4: 2030 with Purple Line from Travel Demand Model

	MWCOG Travel	Future Estimate 2030	
Route	2010-2030 Percent Increase in Max Load Point Volume	Average Peak Hour Passenger Volume	Vehicle Loading Capacity
West Side		*pass*	*pass*
84	41.1%	118	40
B24/B25	305.8%	254	40
B27	23.2%	55	40
F4	-56.2%	81	40
F6	323.9%	208	40
F13	-34.2%	17	40
R12	98.1%	123	40
T16/T17	-27.0%	40	40
T18	-36.9%	104	40
TB15X	-70.6%	2	40
TB16	52.4%	63	40
Subtotal			
East Side			
88	-67.1%	15	40
B21/B22	-15.8%	56	40
B29/B31	-89.4%	5	40
C28	19.0%	58	40
F12 thru	221.3%	96	40
F12 terminate		0	40
F14	120.0%	112	40
921	0.0%	40	40
TB21	137.8%	117	40
TB21x	-31.7%	43	40
Greyhound	0.0%	13	40
Subtotal			
Total			

	Future Estimate 2030					
Route	Peak Hour Headway	Peak Hour Buses/Hour	Average Recovery Time	Average Layover Time	Average Total Time at Bay	Bays Required at NC
West Side	*min*		*min*	*min*	*min*	
84	20	3	5	0	6	0.5
B24/B25	9	7	5	2	8	1.4
B27	30	2	4	0	5	0.3
F4	30	2	5	4	10	0.5
F6	12	5	5	0	6	0.8
F13	30	2	0	0	1	0.1
R12	20	3	5	4	10	0.7
T16/T17	30	2	5	4	10	0.5
T18	20	3	5	3	9	0.7
TB15X	30	2	5	0	6	0.3
TB16	30	2	5	0	6	0.3
Subtotal		**33**				**6.1**
East Side						
88	30	2	0	0	1	0.1
B21/B22	30	2	4	0	5	0.3
B29/B31	30	2	5	0	6	0.3
C28	30	2	4	0	5	0.3
F12 thru	20	3	0	0	1	0.2
F12 terminate	20	3	4	0	5	0.5
F14	20	3	5	1	7	0.6
921	30	2	5	0	6	0.3
TB21	20	3	5	0	6	0.5
TB21x	30	2	5	0	6	0.3
Greyhound	60	1	5	0	6	0.2
Subtotal		**25**				**3.5**
Total		**58**				**13.0**

includes 1 spare bay each side

Figure A5: 2030 Full Build-Out with Travel Demand Model Results

	MWCOG Travel	Future Estimate 2030	
Route	2010-2030 Percent Increase in Max Load Point Volume	Average Peak Hour Passenger Volume	Vehicle Loading Capacity
West Side		*pass*	*pass*
84	39.5%	117	40
B24/B25	329.2%	269	40
B27	42.3%	64	40
F4	-56.2%	81	40
F6	321.4%	206	40
F13	-21.8%	20	40
R12	107.3%	129	40
T16/T17	-25.9%	41	40
T18	-38.3%	101	40
TB15X	-47.1%	3	40
TB16	21.9%	50	40
Subtotal			
East Side			
88	-58.3%	19	40
B21/B22	-13.1%	57	40
B29/B31	-83.8%	8	40
C28	22.6%	60	40
F12 thru	263.2%	109	40
F12 terminate		0	40
F14	145.5%	125	40
921	0.0%	40	40
TB21	157.1%	127	40
TB21x	-31.7%	43	40
Greyhound	0.0%	13	40
Subtotal			
Total			

	Future Estimate 2030					
Route	Peak Hour Headway	Peak Hour Buses/Hour	Average Recovery Time	Average Layover Time	Average Total Time at Bay	Bays Required at NC
West Side	*min*		*min*	*min*	*min*	
84	20	3	5	0	6	0.5
B24/B25	9	7	5	2	8	1.4
B27	30	2	4	0	5	0.3
F4	30	2	5	4	10	0.5
F6	12	5	5	0	6	0.8
F13	30	2	0	0	1	0.1
R12	15	4	5	4	10	0.9
T16/T17	30	2	5	4	10	0.5
T18	20	3	5	0	6	0.5
TB15X	30	2	5	0	6	0.3
TB16	30	2	5	0	6	0.3
Subtotal		**34**				**6.2**
East Side						
88	30	2	0	0	1	0.1
B21/B22	30	2	4	0	5	0.3
B29/B31	30	2	5	0	6	0.3
C28	30	2	4	0	5	0.3
F12 thru	20	3	0	0	1	0.2
F12 terminate	20	3	4	0	5	0.5
F14	20	3	5	1	7	0.6
921	30	2	5	0	6	0.3
TB21	15	4	5	0	6	0.7
TB21x	30	2	5	0	6	0.3
Greyhound	60	1	5	0	6	0.2
Subtotal		**26**				**3.7**
Total		**60**				**13.0**

includes 1 spare bay each side

Figure A6: 2030 Full Build-Out with 46 Percent Increase in Bus Boardings

		Future Estimate 2030	
Route	2010-2030 Percent Increase in Max Load Point Volume	Average Peak Hour Passenger Volume	Vehicle Loading Capacity
West Side		*pass*	*pass*
84	46.0%	123	40
B24/B25	46.0%	91	40
B27	46.0%	65	40
F4	46.0%	271	40
F6	46.0%	72	40
F13	46.0%	38	40
R12	46.0%	91	40
T16/T17	46.0%	80	40
T18	46.0%	240	40
TB15X	46.0%	8	40
TB16	46.0%	60	40
Subtotal			
East Side			
88	46.0%	65	40
B21/B22	46.0%	97	40
B29/B31	46.0%	70	40
C28	46.0%	72	40
F12 thru	46.0%	44	40
F12 terminate	46.0%	0	40
F14	46.0%	74	40
921	46.0%	58	40
TB21	46.0%	72	40
TB21x	46.0%	93	40
Greyhound	46.0%	19	40
Subtotal			
Total			

	Future Estimate 2030					
Route	Peak Hour Headway	Peak Hour Buses/Hour	Average Recovery Time	Average Layover Time	Average Total Time at Bay	Bays Required at NC
West Side	*min*		*min*	*min*	*min*	
84	20	3	5	0	6	0.5
B24/B25	20	3	5	2	8	0.6
B27	30	2	4	0	5	0.3
F4	9	7	5	4	10	1.6
F6	30	2	5	0	6	0.3
F13	30	2	0	0	1	0.1
R12	20	3	5	4	10	0.7
T16/T17	30	2	5	4	10	0.5
T18	10	6	5	3	9	1.3
TB15X	30	2	5	0	6	0.3
TB16	30	2	5	0	6	0.3
Subtotal		**34**				**6.6**
East Side						
88	30	2	0	0	1	0.1
B21/B22	20	3	4	0	5	0.5
B29/B31	30	2	5	0	6	0.3
C28	30	2	4	0	5	0.3
F12 thru	30	2	0	0	1	0.1
F12 terminate	30	2	4	0	5	0.3
F14	30	2	5	1	7	0.4
921	30	2	5	0	6	0.3
TB21	30	2	5	0	6	0.3
TB21x	20	3	5	0	6	0.5
Greyhound	60	1	5	0	6	0.2
Subtotal		**23**				**3.3**
Total		**57**				**13.0**

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